REMARKS

By the subject Office Action, the Examiner has confirmed that dependent claims 4-11 and 15-19 would be allowed if rewritten in independent form. In addition, the Examiner has made final the preliminary rejection of claims 1-3, and 12-14 under 35 USC § 103(a) as allegedly being unpatentable over Lillie et al. of U.S. Patent 4,675,882 (hereinafter "**Lillie**") in view of Upadhyay et al. of U.S. Patent 6,115,409 (hereinafter "**Upadhyay**").

The Examiner rejected applicants' arguments set out in the response filed on 24 August, 2005 and, from a review of the Examiner's statements in the subject Office Action, it is evident that the Examiner has misunderstood key aspects of the cited references and the governing technical effects. These areas of misunderstanding are specifically addressed under the following heading and will become particularly apparent in the separate discussion below of each of the cited references. Absent those misunderstandings, and upon correctly construing the subject matter of **Lillie** and **Upadhyay**, it is respectfully submitted that there is no substantive basis under the law for the Examiner's rejection of claims 1-3, and 12-14 under 35 USC § 103.

A. Examiner's Allegations Evidencing a Misunderstanding of Cited References

The Examiner states in the subject Office Action that **Lillie** "disclose a phase accumulator 204 that receives I and Q channel signals, and outputs *integrated* I' and Q' channel outputs as shown in Fig. 2 [emphasis added]". It is perhaps because this block 204 bears the name "phase accumulator stage" in Fig. 2 which has led the Examiner to make such an erroneous conclusion; in fact, however, this block does NOT output integrated I' and Q' outputs. This is explained in **Lillie** (see col. 3, line 64 to col. 4, line 4) in which it is taught that:

> "...to allow the phase accumulation stage 204 to determine the resultant phase angle of the input signal vector to within $\pi/4$ radians of its actual value. After the determination of the 'coarse' phase value of the input signal vector, the phase

> accumulation stage 204 stores this phase value at a temporary register location, and performs a vector rotation of the signal vector by an amount equal to the negative of the coarse phase value".

Thus, **Lillie** teaches that the function of the "phase accumulator stage 204" is to determine the resultant phase angle of the input signal vector and rotate the signal vector by the negative of that determined angle. It is clear from this, and the circuitry shown and described by **Lillie**, that block 204 does <u>not</u> output integrated I' and Q' channel outputs as stated by the Examiner. It is to be understood, of course, that the mere labeling of block 204 as an "accumulator" does not change its factual functionality or import any particular meaning to that word other than that which **Lillie** actually discloses.

Also in relation to **Lillie**, the Examiner incorrectly states that applicants previously submitted that **Lillie**'s phase accumulator stage block 204 is unrelated to the phase accumulator defined by applicants' claims herein because it doesn't accumulate combined discriminated I and Q vectors. In fact, applicants submission, then and now, is not that **Lillie**'s phase accumulator stage block 204 doesn't accumulate discriminated I and Q vectors <u>but, rather, that it does not accumulate its inputs, period</u>.

Further, the Examiner maintains his position that **Upadhyay** teaches a diversity receiver because it combines phase shifted versions of the received signal from different paths. However, that understanding of the meaning of a "diversity receiver" would be contrary to the functionality and objective of a diversity receiver and, to the accepted meaning of this term in the art, as known to persons skilled in the art. According to the relevant literature in the technical field of the subject invention, of which the text *Electronic Communications Systems* by George Kennedy is just one example (see the enclosed copies of pages 183-184 of this reference), a spatial diversity receiver is a system using the inputs of multiple antennae by switching or combining in order to combat fading due to multi-path propagation. The combining is done in such a way that the addition is constructive for the signal and destructive for the

noise. When a delay is applied to some of the input signals, it's generally to align the signals before combining so the addition is constructive.

In contrast to a spatial diversity receiver, the scheme described in **Upadhyay** combines the input signals after applying a gain and phase to each antennae, so that the signal coming from some directions of arrival (DOA) are cancelled while the signal from some other DOA are accepted. This is known in the art as beamforming (not diversity reception) and beamforming represents a distinct and separate area of technology having nothing to do with the objective of diversity reception, namely, immunity to fading.

In the subject Office Action, the Examiner then proceeds to hypothesize that the outputs from the combiner of **Upadhyay** *when* supplied to the demodulator of **Lillie** could be considered discriminated I and Q vectors, and concludes that the signals received by the phase accumulator are discriminated I and Q signals. However, such a hypothesis *cannot, in fact,* be applied to the claimed invention, the basic principle of which is to add the signals <u>after</u> they are discriminated or demodulated. The discriminator in **Lillie** is the very last block of **Lillie**'s apparatus. Hence, combining the adder of **Upadhyay** followed by the discriminator of **Lillie** *could not* allow the combination of discriminated signals. As a result, such hypothesized modification would render the inventions of **Lillie** and **Upadhyay** unsatisfactory for their intended purpose, and change the principle of operation of the same; such a hypothetical combination of diverse references provides no basis under the law for a finding of obviousness.

Surprisingly, in contradiction to an earlier statement by the Examiner, the Examiner alleges that the digital combiner of **Upadhyay** shown in Fig. 5 is equivalent to a discriminator. He states that the function of a discriminator is to produce an I and Q vector having a phase representative of the frequency and an amplitude proportional to the power of the information signals. To the contrary, the combiner of **Upadhyay** does not perform anything equivalent (or even close) to discrimination and does <u>not</u> produce a vector with a phase representative of the frequency of the signal.

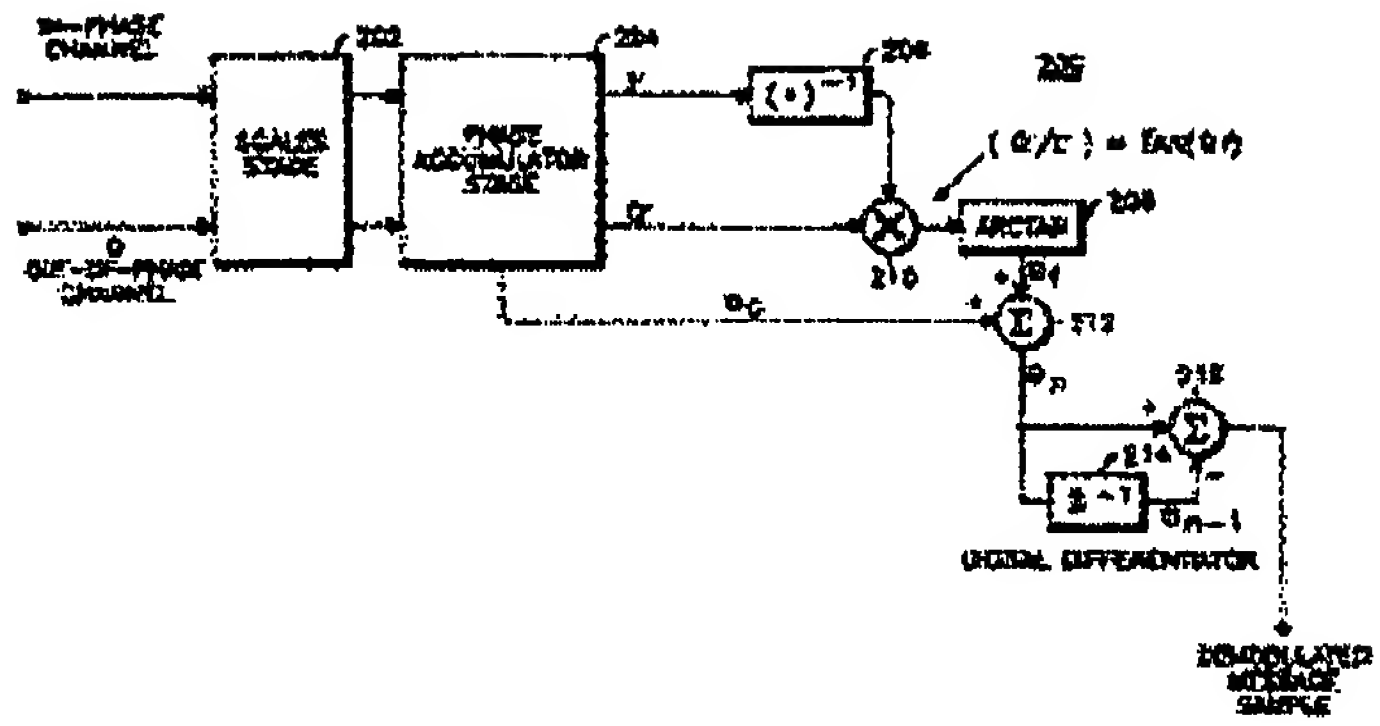
The Examiner refutes applicants' prior submission that the combiner of **Upadhyay** cannot be considered a discriminator because of the absence of a delay. In support of this the Examiner points to the fact that applicants' claims 1 and 12 also do not recite a delay, but this is not relevant since they specifically require a discriminator. What does, in fact, matter with respect to **Upadhyay** is that discrimination consists in finding the rate of fluctuation of a signal and this essential function is not performed by **Upadhyay**'s combiner. The mere combination of the input signal samples at a given sample moment, as shown in the combiner of Upadhyay, *cannot* achieve discrimination because the signal state is only known at that moment. In the case of **Upadhyay**, a delay element would have been mandatory. Applicants' claims 1 and 12, on the other hand, need not recite the use of a delay element because they specifically require the use of a discriminator which could be realized in many ways including with the use of a delay element.

In summary, it is respectfully submitted that the foregoing allegations of the Examiner do not accord with the objective facts. Based on the disclosures of the cited references and the accepted principles of the art no combination of those references could in any way result in the claimed invention.

B. Teachings of the Cited References

1. The invention of **Lillie**

The invention of this patent is best described by Figure 2, a copy of which is reproduced below for purposes of ease of reference.

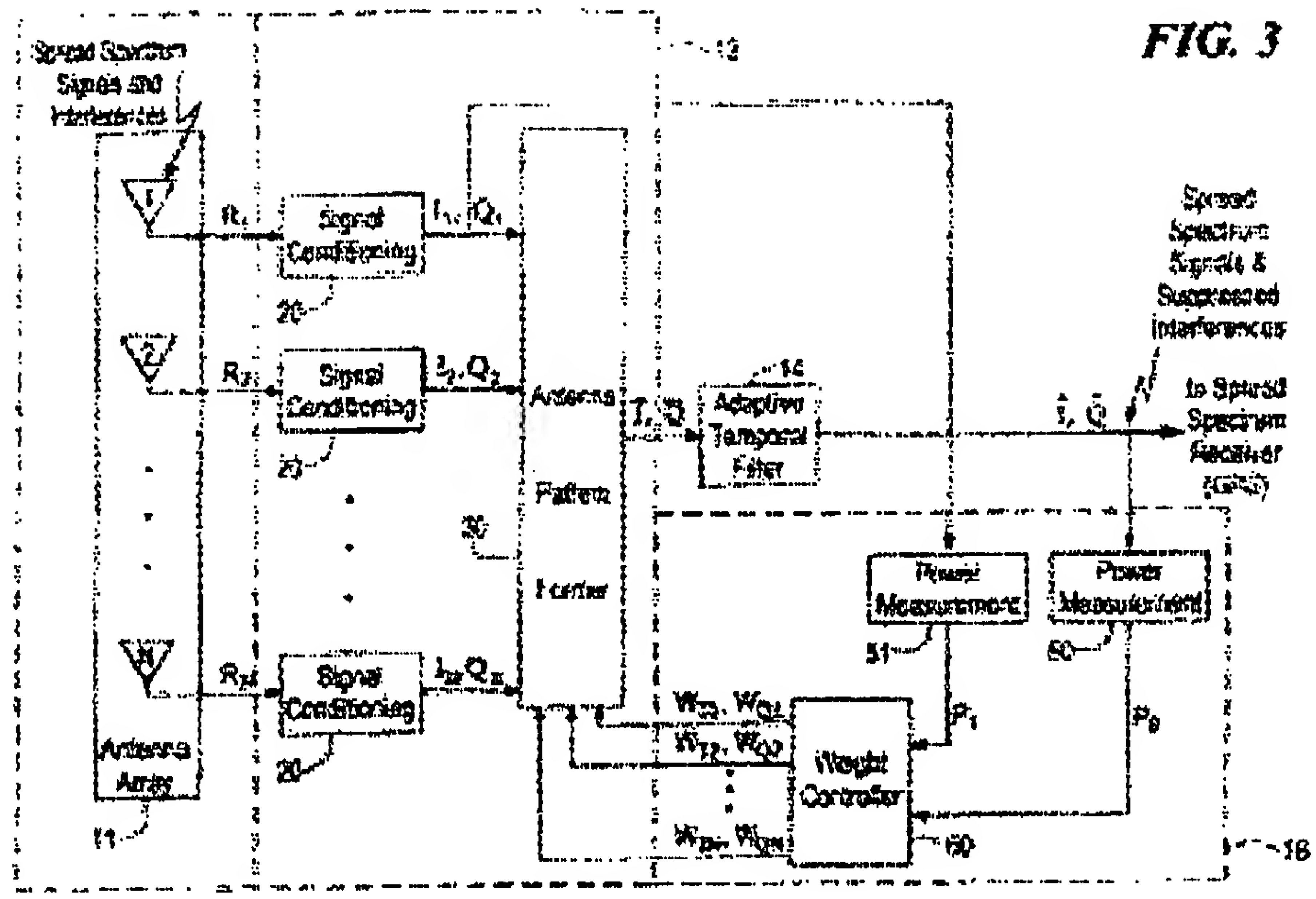


The function accomplished by this invention is unique and consists in demodulating a complex (I and Q) FM modulated signal. This is done by sampling the phase of the input vector and applying a differentiator to it. Block 202 acts as an AGC, by changing the norm of the vector without affecting the phase, so the next blocks are provided with a signal bearing a workable amplitude. The Phase Accumulator Stage block (204), contrary to what such misleading name might be seen to imply, extracts the phase from the input vector. Block 204 provides two signals, as follows. The Θ_C signal is the course phase which is the octant in which the vector lies. The course phase is determined by comparing I and Q's amplitudes and signs. Block 204 also provides a vector I' and Q' bearing the fine phase which is obtained by subtracting the course phase from the input phase by means of a vectorial rotation. The fine phase Θ_f is determined from vector I' and Q' by means of the inverter 206, the multiplier 210 and the arctangent function 208. Adder 212 completes the operation by adding Θ_C and Θ_f to yield Θ_n that is the phase of the input vector I and Q. The last step is the differentiation of the phase Θ_n by blocks 214 and 216. This differentiation produces the demodulated message.

2. The invention of **Upadhyay**

The invention of this patent is best described by Figure 3, a copy of which is reproduced below for purposes of ease of reference.

FIG. 3



The objective of this invention is to remove narrowband and wideband interference signals from the received desired signal. This is accomplished by using an array of antennae. The received signals from the antennae are first conditioned by blocks 20, yielding complex pairs I_n and Q_n. The complex pairs I_n and Q_n are then submitted successively to a spatial filter 30, and a temporal filter 14. Both of these filters are adaptively adjusted to remove some interference signals. The spatial filter removes wideband or narrowband interferers by applying a set of complex weights W_{In} and W_{Qn} to the input complex signals I_n and Q_n. This is equivalent to applying a different gain and delay to each of the input signals, hence forcing a null to some of the angles of arrival of the RF sources and, thus, constituting a beamforming system.

The temporal filter 14 is a transversal filter using time-delayed elements of the output of the spatial filter 30 as inputs. The temporal filter removes any narrowband interference signals that may remain after the spatial filter due to the limited number of

antennae. The set of weights W_{In} and W_{Qn}, optimized to remove the interference signals, are calculated by the Weight Controller block 60 using Power Measurements blocks 50 and 51 outputs.

C. Applicants' Claims Patentably Distinguish over Cited References

Applicants' claims recite "a phase accumulator configured for adding to an accumulation vector, over successive samples, said phases of said combined discriminated vectors ($I_{C\Delta}$, $Q_{C\Delta}$) to produce an output combined I and Q signal pair (I_C, Q_C)". This phase accumulator, therefore, functions to integrate a discriminated signal to regenerate an FM modulated signal. The block termed "phase accumulator stage 204" of **Lillie** performs no such function. To the contrary, it extracts the course phase from an input vector signal and provides a vector I' and Q' bearing the fine phase which is obtained by subtracting the course phase from the input phase by means of a vectorial rotation. The discriminator in **Lillie** is the very last block of **Lillie**'s apparatus and said block 204 of **Lillie** *cannot* perform any such integration function.

As detailed above, the I and Q signal combiner in **Upadhyay** is, in fact, a beamformer, not a diversity combiner. This beamformer is aimed at nulling interference sources while accepting desired sources. By contrast, a diversity combiner would be aimed at selecting the signal from the antennae to mitigate impairments due to fading. The blocks of **Upadhyay** which the Examiner points to as allegedly being discriminators are, in fact, complex multipliers with complex weights. This is done in order to apply a gain and phase-shift to the received signals in the process of implementing a beamformer.

As stated in MPEP § 2143, to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. This requirement is not satisfied. For the reasons stated above, applicants' have shown the

cited references to be diverse teachings without application to applicants' invention. Therefore, such requisite element of "motivation" to combine the references is not present. Nor is there any actual (workable) means to combine the references per the Examiner's suggestion, since combining the adder of **Upadhyay** followed by the discriminator of **Lillie** *could not* allow the combination of discriminated signals. Second, there must be a reasonable expectation of success. This requirement, too, is not satisfied as no combination of the cited references *could* be successful. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. This requirement is not satisfied as the elements of applicants' claims are not taught or suggested by the cited references themselves and it is improper to import to them the teaching of applicants' disclosure.

In view of the foregoing technical facts and considerations, and the misunderstandings which the Examiner has shown in the subject Office Action with respect to the cited references and the governing technical art, applicants respectfully traverse the rejection of claims 1-3, and 12-14 under 35 USC § 103 and request the Examiner to reconsider the same and allow all pending claims as currently presented.

In the event that the Examiner were to elect to maintain the present claim rejections based on **Lillie** in view of **Upadhyay**, the Examiner is required to provide a complete explanation for such decision with notice of both the technical facts relied upon and the source(s) upon which such technical factual allegations are based.

Should the examiner deem a telephone conference to be of assistance in advancing the application to allowance, the examiner is invited to call the undersigned

attorney at the telephone number below.

Respectfully submitted,

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Second Edition

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is an AFC system present, as well as variable selectivity (preferably with a crystal filter), since the bandwidth used for SSB is narrower than for ordinary AM.

Diversity reception This is not so much an additional circuit in a communications receiver as a specialized method of using such receivers. There are two forms: *space diversity* and *frequency diversity*.

Whereas AGC helps greatly to minimize some of the effects of fading, it cannot help when the signal fades into the noise level. Diversity-reception systems make use of the fact that although fading may be severe at some instant of time, some frequency, and some point on earth, it is extremely unlikely that signals at different points or different frequencies will fade simultaneously. (See also Sec. 9-2.2 for a detailed description of fading, its various causes and its effects upon reception.)

Both systems are in constant use, by communications authorities, commercial point-to-point links and the military. In space diversity, two or more receiving antennas are employed, separated by nine or more wavelengths. There are as many receivers as antennas, and arrangements are made to ensure that the AGC from the receiver with the strongest signal at the moment cuts off the other receivers. Thus only the signal from the strongest receiver is passed to the common output stages.

Frequency diversity works in much the same way, but now the same antenna is used for the receivers, which work with simultaneous transmissions at two or more frequencies. Since frequency diversity is more wasteful of the frequency spectrum, it is used only where space diversity cannot be employed, such as in restricted spaces where receiving antennas could not have been separated sufficiently. Ship-to-shore and ship-to-ship communications are the greatest users of frequency diversity at HF.

As described, both systems are known as *double-diversity* systems, in that there are two receivers employed in a diversity pattern. Where conditions are known to be critical, as in *tropospheric scatter* communications, *quadruple diversity* is used. This is a space-diversity system which has receiver arrangements as just described, with two transmitters

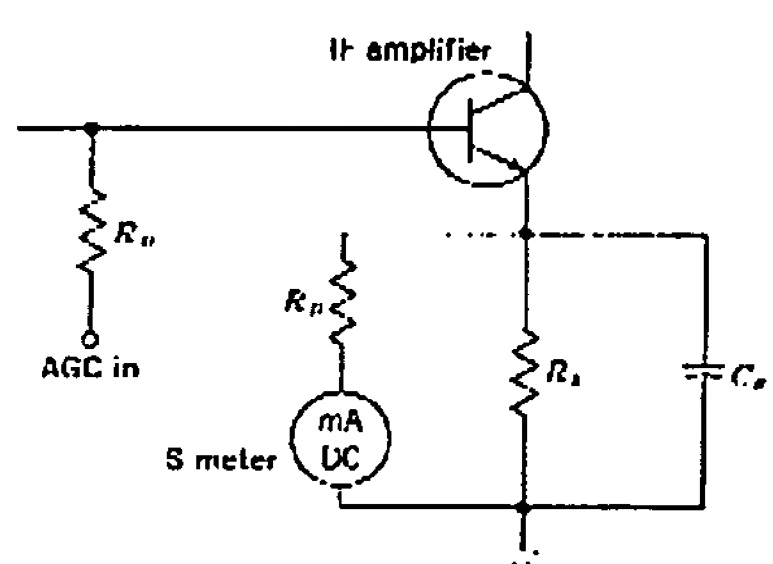

Fig. 7-22 S meter.

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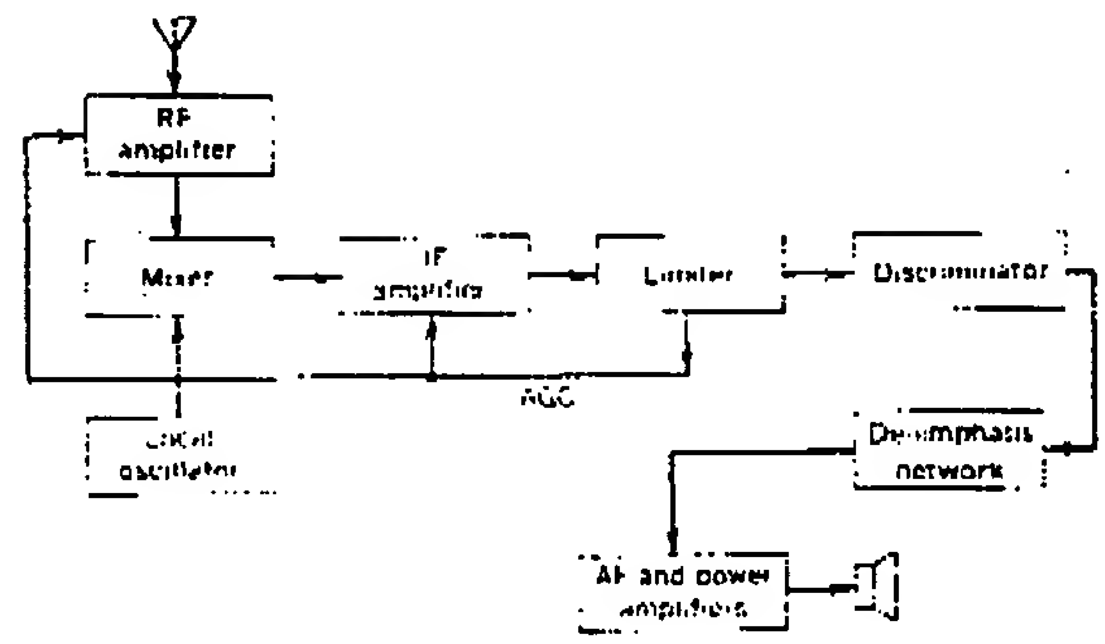

Fig. 7-23 FM receiver block diagram.

at each end of the link arranged just like the receivers. This ensures tha signals of adequate quality will be received under even the worst pos sible conditions. (See Sec. 9-2.4, where tropospheric scatter is describe fully and the use of diversity with it is discussed, and also Ref. 7.)

There is one snag, unfortunately, that applies to diversity system and limits their use in voice communications. Since, in general, eac signal travels over a slightly different path, the audio output will hav a phase difference when compared with that of the other receiver(s As a result, diversity reception is used very often for telegraph d data transmission (i.e., pulses), but present diversity systems for voi communications leave much to be desired, unless some form of pul modulation is employed for the voice transmission (the most popu form is *pulse-code modulation,* as described in Sec. 15-2.4).

7-4 FM RECEIVERS

The FM receiver is a superheterodyne receiver, and the block diagra of Fig. 7-23 shows just how similar it is to an AM receiver. The bas difference are as follows:

1. Much higher operating frequencies in FM.
2. Need for limiting and de-emphasis in FM.
3. Totally different methods of demodulation.
4. Different methods of obtaining AGC.

7-4.1 Common Circuits—Comparison with AM Receivers

A number of sections of the FM receiver correspond exactly to those other receivers already treated: for example, the same criteria apply the selection of the intermediate frequency, and IF amplifiers are b